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08/19/2010 /Pamela Gerik/
Date Pamela Gerik

DECLARATION OF MELINDA E. WALES, PH.D. UNDER 37 C.F.R. § 1.132

I, Melinda E. Wales, do hereby declare and state that:

My Education and Experience in Biotechnology

1. I received a Bachelor of Science in Microbiology and a Ph.D. in Genetics, both from Texas A&M University.

2. I have worked as a scientist at Texas A&M University, investigating bacterial metabolic engineering, protein structure/function and protein families.

3. I am currently the Chief Scientific Officer at Reactive Surfaces, Ltd.

4. I have extensive experience in biotechnology including bacterial expression systems, scale-up of enzyme production processes, protein structure/function, protein design and the application of enzymes to environmental problems.

5. I have authored over thirty scientific articles and two patent applications in the biotechnology field. My curriculum vitae is attached hereto as Exhibit A.

The Rejection of Claims of U.S. Patent Application No. 10/655,345 Under 35 U.S.C. §§ 112, first paragraph and 35 U.S.C. §§ 112, second paragraph

6. I have reviewed U.S. Patent Application No. 10/655,345 to C. Steven McDaniel ("Dr. McDaniel") titled, "Biological Active Coating Components, Coatings, and Coated Surfaces" (referred to herein as "the '345 application"). In addition, I have reviewed independent claims 1, 272, 319, 368, 393 and 394 and dependent claims 17, 19 and 21-27 of the '345 application as well as amendments proposed for such claims by Dr. McDaniel which are to be submitted in a response to the office action filed in conjunction with this declaration.

7. I am familiar with the United States Patent and Trademark Office Action dated 02/19/2010 (referred to herein as "the office action") rejecting claims 1, 15-27, 67, 69-75, 79-89, 94-100, 102, 110-119, 121-135, 180-182, 217, 219-242, 251-255, 272, 309, 319-321, 323, 324, 326, 343-356, 360-362, 365-373, 376-385 and 389-394 of the '345 application. In particular, I have reviewed:

- The Examiner's basis for the rejections of claims 21-27 of the '345 application under 35 U.S.C. § 112, second paragraph as being indefinite for failing to particularly point out and distinctly claim the subject matter which the applicant regards as the invention as set forth on pages 5-6 of the office action; and

- The Examiner's basis for the rejections of claims 1, 15-27, 67, 69-75, 79-89, 94-100, 102, 110-119, 121-135, 180-182, 217, 219-242, 251-255, 272, 309, 319-321, 323, 324, 326, 327, 343-356, 360-362, 365-373, 376-385 and 389-392 of the '345 application under 35 U.S.C. § 112, first paragraph for enablement and written description as set forth on pages 6-18 of the office action.

8. I have reviewed the paper entitled "*Identification of Regions in Interleukin-1α Important for Activity*" to *Gayle* et al. (referred to herein as "*Gayle* et al.") and the paper entitled "*Prediction of protein function from protein sequence and structure*" to *Whisstock* et al. (referred to herein as "*Whisstock* et al."), which are cited as evidence to support the rejections of enablement and written description.

Analysis of the 112, Second Paragraph Rejection of Independent Claims 21-27

9. I understand that the Examiner deems the phrases "functional equivalent", "structural analog", and "sequence analog" indefinite. In particular, the Examiner states on page 6 of the office action that the structural and functional limitations of the genera of any "functional equivalent", "structural analog", and "sequence analog" is unclear and the skilled artisan would not know the metes and bound of the recited invention. More specifically, the Examiner states that the statements made in paragraphs [0121] and [0169] of the specification do not define the phrases "functional equivalent", "structural analog", and "sequence analog" because:

(i) disclosure of what activity the encompassed enzymes may possess is not disclosure of what activity the encompassed enzymes do possess;

(ii) examples are not definitive;

(iii) the 'desirable chemical reactions', 'other desired enzymatic properties', 'desirable property', and 'undesirable property' are not defined;

(iv) the terms 'similar' and 'such as' are indefinite.

10. I have been informed by Dr. McDaniel, the patent attorney of record for the '345 application, of the following patent examination rules and guidelines:

- The second paragraph of 35 U.S.C. 112 is directed to two separate requirements for the claims: (A) the claims must set forth the subject matter that applicants regard as their invention; and (B) the claims must particularly point out and distinctly define the metes and bounds of the subject matter that will be protected by the patent grant (which refers to 'definiteness' of the claims). (MPEP 2171);

- The invention set forth in the claims must be presumed, in the absence of evidence to the contrary, to be that which applicants regard as their invention. *In re Moore*, 439 F.2d 1232, 169 USPQ 236 (CCPA 1971). Evidence that shows that a claim does not correspond in scope with that which applicant regards as applicant's invention may be found, for example, in contentions or admissions contained in briefs or remarks filed by applicant, or in affidavits filed under 37 CFR 1.132, but the content of applicant's specification is not to be used.

- The essential question under 35 U.S.C. 112, second paragraph, is whether the claims do, in fact, set out and circumscribe a particular area with a reasonable degree of precision and particularity. Definiteness of claim language is analyzed, not in a vacuum, but always in light of the teachings of the prior art and of the particular application disclosure as it would be interpreted by one possessing the ordinary level of skill in the pertinent art. *In re Moore*, 439 F.2d 1232, 169 USPQ 236 (CCPA 1971). See also MPEP 2173.02.

- The test for definiteness under 35 U.S.C. 112, second paragraph, is whether "those skilled in the art would understand what is claimed when the claim is read in light of the specification." *Orthokinetics, Inc. v. Safety Travel Chairs, Inc.*, 806 F.2d 1565, 1576, 1 USPQ2d 1081, 1088 (Fed. Cir. 1986) (MPEP 2173.02).

- The meaning of every term used in a claim should be apparent from the prior art or from the specification and drawings at the time the application is filed. Applicants need not confine themselves to the terminology used in the prior art, but are required to make clear and precise the terms that are used to define the invention whereby the metes and bounds of the claimed invention can be ascertained. During patent examination, the pending claims must be given the broadest reasonable interpretation consistent with the specification. *In re Morris*, 127 F.3d 1048, 1054, 44 USPQ2d 1023, 1027 (Fed. Cir. 1997); *In re Prater*, 415 F.2d 1393, 162 USPQ 541 (CCPA 1969).

- If the claims, read in light of the specification, reasonably apprise those skilled in the art both of the utilization and scope of the invention, and if the language is as precise as the subject matter permits, the statute (35 U.S.C. 112, second paragraph) demands no more. *Shatterproof Glass Corp. v. Libbey Owens Ford Co.*, 758 F.2d 613, 225 USPQ 634 (Fed. Cir. 1985)

11. I am not aware of any evidence showing claims 21-27 do not correspond in scope with that which the applicant regards as his invention. Based on the *In re Moore* case law noted above, it is my understanding that the claims must be presumed to be that which the applicant regards as his invention.

12. The phrase 'functional equivalent to the wild-type enzyme' is clearly defined in paragraph [0121] of the specification as a proteinaceous molecule comprising a sequence and/or a structural analog of a wild-type enzyme's sequence and/or structure and functions as an enzyme. The term "structural analog" is also clearly defined in paragraph [0169] of the specification as one or more chemical modifications to the peptide backbone or non-side chain chemical moieties of a proteinaceous molecule. Furthermore, the term "sequence analog" is clearly defined in paragraph [0169] of the specification as one or more chemical modifications to the side chain chemical moieties, also known herein as a "residue" of one or more amino acids that define a proteinaceous molecule's sequence.

13. In addition to providing clear definitions to the terms "sequence analog" and "structure analog", paragraph [0169] of the specification provides examples of chemical modifications which may constitute the terms. In addition, paragraph [0121] provides examples of functional equivalents of a wild-type enzyme as well as examples of enzymatic properties which a functional equivalent enzyme may possess. I believe one skilled in the art of biotechnology would readily recognize that the examples provided in the specification are offered to support the definitions set forth for the terms, but in no way serve an exhaustive list of possibilities encompassed by the terms. The terms and phrases "example", "such as" and "may possess" used in such descriptions of the specification acerbate this assertion as a skilled artisan in any

scientific field recognizes that examples are not definitive, the term "such as" refers to examples, and the use of the term "may" does not constitute a necessity. Based on the *In re Moore* case law noted above, it is my understanding that such indefiniteness in the examples disclosed in the specification does not render the terms "functional equivalent", "structural analog", and "sequence analog" indefinite. In particular, it is my understanding that the terms must not be analyzed in a vacuum and, thus, are not restricted to examples and disclosures in the specification. Rather, it is my understanding the the terms must be evaluated as to how one skilled in the art would interpret the terms based on the disclosure of the application.

14. As one skilled in the art of biotechnology, I understand that EC 3.1.8 defines functional equivalence to be limited to hydrolysis of phosphoric triesters. Within this functional context, I interpret the terms "functional equivalent", "structural analog", and "sequence analog" used in claims 21-27 to refer to a progressively more discreet grouping of enzymes which share a function limited to EC 3.1.8 (i.e., phosphoric triester hydrolases). This functional class of enzymes is informed by dependent claims 17, 19 and 21, can be easily defined by academic literature over the past 20 years, and is further limited by the structural and sequence attributes as exemplified in dependent claim 21. There is sequence divergence represented in EC 3.1.8, but the enzymes of claim 21 exemplify a specific class of EC 3.1.8 of limited sequence divergence.

15. Based on the aforementioned assessment, I believe the metes and bounds of the terms "functional equivalent", "structural analog", and "sequence analog" in claims 21-27 are clear and those skilled in the art of biotechnology and, more particularly, enzymology would be apprised of their scope based on the description of such terms in the specification as well as what is readily known in the art of biotechnology.

Analysis of the 112, First Paragraph Rejections of Independent Claims 1, 272, 319, 368, 393 and 394 for Enablement and Written Description

16. I understand that the Examiner deems that the specification of the '345 application does not reasonably enable any person skilled in the art to make and use any type of paint, comprising any components, and comprising any active enzyme of E.C. 3.1.8. (page 7 of the office action).

In particular, I understand the Examiner deems the specification as not supporting the broad scope of claims 1, 272, 319, 368, 393 and 394 because the Examiner does not believe the specification establishes the following points as noted on pages 9 and 10 of the office action:

(A) the structure of any enzyme of E.C. 3.1.8, or variants or analogs thereof, that are active within any paint, comprising any components;

(B) regions of any enzyme having the desired biological characteristics that may, or may not, be modified without affecting the activity within any paint;

(C) the general tolerance of any E.C. 3.1.8 enzyme, having activity within any paint, to the modification and extent of such tolerance;

(D) a rational and predictable scheme for identifying or making the genus of E.C. 3.1.8 enzymes having activity within any paint;

(E) the compositions of paints that allow enzymes of E.C. 3.1.8 to be active;

(F) the compositions of paints that inhibit the activity of E.C. 3.1.8 enzymes;

(G) components of any paint that may, or may not, be modified without affecting the activity of any E.C. 3.1.8 enzyme;

(H) a rational and predictable scheme for identifying components of paints having the desired property of allowing any E.C. 3.1.8 enzyme to be active;

(I) the identity of any paints wherein the comprised enzyme of E.C. 3.1.8 is stable for more than one month or more than one year; and

(J) the specification provides insufficient guidance as to which of the essentially infinite possible choices is likely to be successful.

17. I understand the Examiner provides the following bases to support the rejection of enablement:

- Since the amino acid sequence of a protein determines its structural and functional properties, predictability of which changes can be tolerated in a protein's amino acid sequence and obtain the desired activity in paint, comprising any components, requires a knowledge of and guidance with regard to which amino acids in the protein's sequence, if any, are tolerant of modification and which are conserved (i.e., expectedly intolerant to

modification), and detailed knowledge of the ways in which the protein's structure relates to its function. (page 8 of the office action)

- While recombinant and mutagenesis techniques as well as methods for testing the activity of E.C. 3.1.8 enzymes are known, it is not routine in the art to screen an essentially unlimited number of proteins and variants and analogs thereof for activity within any paint comprising any components ... (page 9 of the office action)

- Furthermore, the positions within a protein's sequence where amino acid modifications can be made with reasonable expectation of success in obtaining the desired activity/utility are limited in any protein and the results of such modifications are unpredictable (Galye et al, 1993; Whisstock et al, 2003). (page 9 of the office action)

- In addition, one skilled in the art would expect any tolerance to modification to any given protein having the desired biological characteristics to diminish with each further and additional modification. (page 9 of the office action)

- Without sufficient guidance, determination of the identity of paints having the desired biological characteristics is unpredictable and the experimentation left to those skilled in the art is unnecessarily, and improperly, extensive and undue." (page 10 of the office action).

18. I understand that the Examiner deems that claims 1, 272, 319, 368, 393 and 394 contain subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor, at the time the application was filed, had possession of the claimed invention. (page 17 of the office action).

19. I have been informed by Dr. McDaniel, the patent attorney of record for the '345 application, of the following patent examination rules and guidelines:

- The enablement requirement refers to the requirement of 35 U.S.C. 112, first paragraph that the specification describe how to make and how to use the invention. The invention that one skilled in the art must be enabled to make and use is that defined by the claim(s) of the particular application or patent. (MPEP 2164);

- To comply with 35 U.S.C. 112, first paragraph, it is not necessary to "enable one of ordinary skill in the art to make and use a perfected, commercially viable embodiment absent a claim limitation to that effect." *CFMT, Inc. v. Yieldup Int'l Corp.*, 349 F.3d 1333, 1338, 68 USPQ2d 1940, 1944 (Fed. Cir. 2003). Detailed procedures for making and using the invention may not be necessary if the description of the invention itself is sufficient to permit those skilled in the art to make and use the invention. (MPEP 2164);

- The test of enablement is whether one reasonably skilled in the art could make or use the invention from the disclosures in the patent coupled with information known in the art without undue experimentation. A patent need not teach, and preferably omits, what is well known in the art. (MPEP 2164.01);

- The fact that experimentation may be complex does not necessarily make it undue, if the art typically engages in such experimentation. *In re Certain Limited-Charge Cell Culture Microcarriers*, 221 USPQ 1165, 1174 (Int'l Trade Comm"n 1983), *aff'd. sub nom., Massachusetts Institute of Technology v. A.B. Fortia*, 774 F.2d 1104, 227 USPQ 428 (Fed. Cir. 1985) (MPEP 2164.01);

- To satisfy the written description requirement, a patent specification must describe the claimed invention in sufficient detail that one skilled in the art can reasonably conclude that the inventor had possession of the claimed invention. (MPEP 2163); and

- Possession of the invention that is claimed may be shown in a variety of ways including description of an actual reduction to practice, or by showing that the invention was "ready for patenting" such as by the disclosure of drawings or structural chemical formulas that

show that the invention was complete, or by describing distinguishing identifying characteristics sufficient to show that the applicant was in possession of the claimed invention. See, e.g., *Pfaff v. Wells Elecs., Inc.*, 525 U.S. 55, 68, 119 S.Ct. 304, 312, 48 USPQ2d 1641, 1647 (1998); *Eli Lilly*, 119 F.3d at 1568, 43 USPQ2d at 1406; *Amgen, Inc. v. Chugai Pharmaceutical*, 927 F.2d 1200, 1206, 18 USPQ2d 1016, 1021 (Fed. Cir. 1991) (MPEP 2163.02).

20. As one skilled in the art of biotechnology, I believe the specification of the '345 application clearly and sufficiently describes the manner of making and using coatings, elastomers, adhesives, sealants, and waxes including any active enzyme of E.C. 3.1.8. In particular, I believe the specification provides ample guidance and direction on combining enzymes with various coating, elastomer, adhesive, sealant, and wax components to produce coatings, elastomers, adhesives, sealants, and waxes having an enzyme. In addition, I believe the specification provides ample guidance and direction on adding enzymes to prepared coatings elastomers, adhesives, sealants and waxes to produce coatings, elastomers, adhesives, sealants, and waxes having an enzyme. I believe the specification clearly sets forth the enzyme formulated with such coatings, elastomers, adhesives, sealants, and waxes may be any active enzyme of E.C. 3.1.8. Moreover, I believe the specification clearly sets forth how to make coatings, elastomers, adhesives, sealants, and waxes comprising enzymes with any known components for imparting desired properties for coatings, elastomers, adhesives, sealants, and waxes, such as but not limited to binders, fillers, and preservatives, for example. I believe the specification clearly sets forth how to use coatings, elastomers, adhesives, sealants, and waxes comprising an enzyme, specifically by applying the coatings, elastomers, adhesives, sealants, and waxes to a surface.

21. Those of skill in the art of biotechnology are aware and readily recognize that an active enzyme of E.C. 3.1.8 may be derived by techniques which are known in the art. In particular, directed or molecular evolution (also called evolutive biotechnology) involves either random mutagenesis of the gene encoding the catalyst (e.g. by error-prone PCR) or recombination of gene fragments (e.g. derived from DNase degradation, a staggered extension process or random priming recombination). Libraries created in this manner are then screened using high-throughput

technologies to identify active analogs. To achieve this, the gene(s) encoding the enzyme(s) of interest (such as those identified by reference to EC 3.1.8 known and available to those in the art), a suitable expression system, and a sensitive assay for the desired function, such as that described in the specification of the '345 application, is used.

22. The '345 application clearly sets forth how to analyze and test the enzymatic activity of coatings, elastomers, adhesives, sealants, and waxes formulated with enzymes. It is my further belief that one skilled in the art of biotechnology would be apprised, simply on their knowledge of enzymes, of how to analyze and test the enzymatic activity of coatings, elastomers, adhesives, sealants, and waxes formulated with enzymes. As such, I believe those skilled in the art of biotechnology would be apprised of how to identify a structure of an enzyme of EC 3.1.8, or variants or analogs thereof, which are active within a coating, elastomer, adhesive, sealant, or wax.

23. I believe one skilled in the art would be able to ascertain the tolerance of enzymes identified to be active in coatings, elastomers, adhesives, sealants, and waxes, regarding modification and extent of the tolerance. In addition, I believe one skilled in the art of biotechnology would be able to ascertain the regions of any enzymes which may or may not be modified without affecting enzyme activity within a coating, elastomer, adhesive, sealant, or wax. Based on such, I believe one skilled in the art would be able to establish a rational and predictable scheme for identifying or making a genus of EC 3.1.8 enzymes having activity within a coating, elastomer, adhesive, sealant, or wax. In particular, the limitation of enzymes of interest to EC 3.1.8 in independent claims 1, 272, 319, 368, 393 and 394 specifically identifies aryl esters and organophosphate compounds as the functional target. These substrates have no apparent physiological significance, and so qualify as "promiscuous substrates". Gene or amino acid sequences attributed to ancillary or promiscuous activities are documented to be more plastic than those associated with essential functions, such as those described by Gayle and Whisstock. Directed laboratory evolution experiments, including those reported for sequences derived from the EC 3.1.8 class, demonstrate this plasticity. As such, I find the citation of Gayle and Whisstock and the accompanying assertion by the Examiner on page 9 of the office action, in part, not applicable to the subject matter recited in independent claims 1, 272, 319, 368, 393 and 394. In particular, as one skilled in the art, I believe results of modifications

to an EC 3.1.8 enzyme can be readily and easily screened to identify active variants. Furthermore, I disagree with the Examiner's overly vague assertion on page 9 of the office action that the tolerance of modification for any given protein diminishes with each additional modification. In particular, I am aware of eighteen different cases that have been published in the art of biotechnology in which one to four mutations increased the promiscuous activity of proteins, but hardly affected the original activity of these proteins.

24. Techniques for identifying active enzymes of E.C. 3.1.8 are not only known in the art of biotechnology, but are routinely performed in the art of biotechnology. Furthermore, although the number of enzymes to screen for applicable activity in a coating, elastomer, adhesive, sealant, or wax may be vast, the number is not unlimited as purported by the Examiner and screening such a number does not undue experimentation. One technique commonly used is to introduce genetic diversity into the genes by error-prone PCR amplification under conditions that induce, on average, a few mutations per gene. The resulting gene libraries are cloned into an expression vector and transformed into an expression system. Screening with the target substrate and in the environment of choice typically requires that only several thousand clones from the libraries be screened to identify positive colonies (commonly determined by the appearance of a colored or fluorescent product). Since the basis of the screen is a detectable function and the introduction of the variation is random, aprior knowledge of sequence or plasticity is not required. These techniques are performed routinely both in research laboratories and are taught in student laboratories at most universities. Such assays may be conducted with an enzyme incorporated into a coating, elastomer, adhesive, sealant, or wax, described in the '345 application. As such, the selection of various sequences to test for enzymatic activity is not complex but routine in the art, and does not require undue experimentation.

25. Upon review of the '345 application, it is my understanding that it is well known in the art of coatings and the material sciences of elastomers, adhesives, sealants, and waxes of how to analyze and test coatings, elastomers, adhesives, sealants, and waxes for suitable properties associated with different components of the coatings, elastomers, adhesives, sealants, and waxes. As stated above, the '345 application also clearly sets forth how to analyze and assay the enzymatic

activity of coatings, elastomers, adhesives, sealants, and waxes formulated with enzymes. Based on such, I believe one skilled in the art of coatings and the material sciences of elastomers, adhesives, sealants, and waxes would be apprised of how to analyze coatings, elastomers, adhesives, sealants, and waxes formulated with an E.C. 3.1.8 enzyme to determine which, if any, components of the coatings, elastomers, adhesives, sealants, and waxes may, or may not, be modified without affecting the activity of the enzyme.

26. I believe the specification of the '345 application provides ample written description to make it clear that the inventor of the claimed subject matter had possession that scope of the invention encompassed any type of coating, elastomer, adhesive, sealant, and wax comprising any components and comprising any active enzyme of E.C. 3.1.8.

27. Based on my understanding on the aforementioned patent examination rules and guidelines and my review of the '345 application, it is my understanding that the specification provides ample enablement and written description for the subject matter recited in claims 1, 272, 319, 368, 393 and 394.

28. I declare that all statements made herein of my own knowledge are true and that all statements made herein of my own belief are believed to be true. I further declare that these statements were made with knowledge that willful false statements and the like are punishable by fine or imprisonment, or both, under Section 1001, Title 18 of the United States Code and that such willful false statements may jeopardize the validity of this application and any patent issued thereon.

19-Aug-2010 /Melinda E. Wales/

Date Melinda E. Wales, Ph.D.

EXHIBIT A

Curriculum Vitae

MELINDA E. WALES
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Education: B.S. (Microbiology) Texas A&M University, 1978
PhD (Genetics) Texas A&M University, 1984
Postdoctoral Fellow (Biochemistry/Molecular Biology) Texas A&M University, 1984-1986

Professional Positions:
Teaching Assistant, Genetics, Texas A&M University (1978-1979)
Instructor, Genetics, Texas A&M University (1979-1982)
NSF Graduate Research Associate, Department of Biochemistry & Biophysics, Texas A&M University, (1982)
Robert A. Welch Postdoctoral Fellow, Department of Biochemistry & Biophysics, Texas A&M University (1985)
Visiting Assistant Professor, Genetics, Texas A&M University (1988)
Visiting Assistant Professor, Department of Biochemistry & Biophysics, Texas A&M University (1989)
Associate Research Scientist, Department of Biochemistry & Biophysics, Texas A&M University (1991-2002)
Scientific Consultant, Reactive Surfaces, Ltd. (2002-2005)
Research Scientist, Dept. Biochemistry & Biophysics, TAMU (2003 – 2009, 50% Effort)
Research Scientist, Dept. Biochemistry & Biophysics and Dept Chemical Engineering, TAMU (2010, 50% Effort)
Chief Scientific Advisor, Reactive Surfaces, Ltd. Austin, TX (2005 – 2007)
Chief Scientific Officer, Reactive Surfaces, Ltd., Austin, TX (2007 – present)

Professional Experience:
- Comparative analysis of microbial metabolic and enzymatic systems
- Molecular biology and enzymology of pyrimidine metabolism of diverged microbial systems
- The application of molecular techniques in the analysis of proteins
- Biotechnology: development of new laboratory space for small biotech company, hiring and oversight of R&D personnel, shepherding production commercializing from bench scale through 1000 liter fermentation volumes, including EPA approvals and downstream processing, in addition to serving as Project Director on all R&D projects.
- NSF Review Panels (2009-2010):
  - Integrative Graduate Education and Research Traineeship (IGERT)-BENG Pre-proposal Review Panel
  - Chemical, Bioengineering, Environmental, and Transport Systems (CBET) Proposal Review Panel,
  - Chemical, Bioengineering, Environmental, and Transport Systems (CBET) Proposal Review Panel, Molecular Biosensing
- DTRA-JSTO Review (2009)

- Chemical and Biological Technologies (CBT)- Medical Science and Technology Division (CBM)
- Chemical and Biological Technologies (CBT) - Physical Science and Technology Division

- Manuscript Reviews (most recent): Biotechnology Progress, Environmental Science & Technology, Journal of Biomolecular Techniques, Sensors Journal

Research Experience:

- Investigation of major metabolic pathways of microorganisms, prokaryotic and eukaryotic: cell growth and monitoring (bench top to 800 L); analysis of metabolites, intra- and extracellular; creation of knockout mutations and chromosomal replacement (prokaryotic).
- Protein biochemistry: protein expression, protein purification utilizing standard and FPLC chromatographic procedures; enzymatic characterization; electrophoretic detection and analysis including western blot and activity staining.
- Molecular biology: plasmid construction, cloning, strain construction, nucleic acid blotting (northern, southern and colony lifts); nucleic acid purification (plasmid and genomic); genomic library construction (prokaryotic); gene sequencing and analysis, PCR
- Immunology: hybridoma production and storage; monoclonal antibody production and screening, including ELISA, hemolysis, etc.; polyclonal antibody production and screening; immunoprecipitation; western blot analysis.

Administrative Experience:

- Academic:
  - Grant and manuscript preparation
    - Author and co-PI of funded grants from NSF and NIH
    - Author of funded grants from The Welch Foundation
  - Project management and budgeting, including management of up to 5 concurrent, independent projects, and 24 scientist
  - Member, Agriculture Program 21 Internal Visioning Network (2002)
- Industrial:
  - Project Director for multiple R&D projects, including government, industrial and university collaborative agreements
  - Project management and budgeting, supervision and budgeting for R&D personnel and laboratory space and equipment
  - Supervise process development, scale-up and regulatory efforts

Teaching Experience (selected to emphasize diversity):

- **Genetics 301** describes the fundamental principles of genetics, including the physical basis of Mendenlian inheritance, expression and interaction of genes. This is the genetics course required by such diverged majors as horticulture, animal science, biology, genetics, biochemistry, pre-med, and many others. As such, the class is both large (typically 150-200 students) and diverse. This class has a lab associated with it, which I have also taught.
- **Genetics 310** (Principles of Heredity) describes the basic principles of classical genetics, molecular genetics, mutation theory and genetic engineering. This course was the genetics course for non-science majors. The class size is smaller (50-80) and the students tend to be less familiar with general scientific terms and concepts. This class is more relaxed than 301, as such it leaves more opportunity for discussion of current topics and issues of interest to the students. There is no laboratory associated with this class.

- **Genetics 320** (Biomedical Genetics) describes the fundamental genetic principles as applied to biomedical science; Mendelian inheritance, linkage and gene mapping, mutagenesis and pedigree analysis; molecular basis of gene function and inherited diseases, gene therapy. This is an alternative to 301, with no associated lab and is often taken by pre-med students.
- **Genetics 281** (Problems in Genetics) is a special problems course for undergraduates permitting laboratory investigations of subject matter not included in established courses. I have anywhere from 3-5 undergraduates working in the laboratory on research projects each semester, they are freshman or sophomore majors in Biochemistry or Genetics. They work on research projects, with their own interest and commitment being the limiting factor.
- **Genetics 485** (Problems in Genetics), similar to Gen 281, except this is for advanced undergraduates, typically junior or senior classification, to permit laboratory investigations or study of subject matter not included in established courses. They work on research projects, with their own interest and commitment being the limiting factor.
- **Genetics 491** (University Undergraduate Fellows Honors Program) Mentoring Sr year, undergraduate students through a research project, presentations and final paper. Over the past ten years, I have had four students win the Outstanding Research Award, and I have received the University Undergraduate Fellows Advisor Award, a commendation usually reserved for tenure-track faculty. All of these students have gone on to professional school (medicine, dentistry, etc) or graduate school. In addition, these students usually present a paper at a regional or national meeting.
- **Curriculum development** for a 3 module, project-based laboratory for a new undergraduate biotechnology major at the University of Houston.

Selected Professional Awards and Activities:

Research Award of Excellence, Dept of Biochemisty & Biophysics, TAMU (2004)
Trustee Allen Academy, Science and Education (1997 – 2004)
Panelists: National Assessment of Educational Progress in Science (1996)
Scientist: Houston/Boston's Children's Museum Science-by-Mail Advisor (1994 – 1996)
Outstanding Undergraduate Fellows Advisor (1992)

Publications:

1. Novikov, B.N., Grimsley, J.K., Wild, J.R., Wales, M.E. 2010. Improved Pharmacokinetics and Immunogenicity Profile of Organophosphorus Hydrolase by Chemical Modification with Polyethylene Glycol. J Controlled Release. In press.
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Invited Publications (select):

1. Wales, M.E., Novikov, B., Wild, J.R. The Structural Divergence and Regulatory Logic in the Evolution of ATCases. In "Molecular Anatomy and Physiology of Proteins" (ed. G. Herve). In Press.
2. Kern, R.J., Wales, M.E., Tiffany-Castiglioni, E., Wild, J.R. 2009. Protection of Acetylcholinesterase from Organophosphates: Kinetic Insight into Bioscavengers. In. Handbook Of Toxicology Of Chemical Warfare Agents (ed. Gupta, R.C.) pp. 374-484.
3. Rawlins, J.W.; Wales, M.E. 2008. Putting Nature to Work. Eur Coatings J 11(08):26-32. **[Winner: Best New Technology at the 2008 American Coatings Conference]**
4. Wales, M.E., McDaniel, C.S., Kern, R. and Wild, J.R. 2007. Enzyme Technology: Applications for the Decontamination of Organophosphorus Agents. In Proceedings of the OPCW Academic Forum (ed. Ralf Trapp), pp 221-234.
5. Wales, M.E.; McDaniel, C.S.; Everett,A.L., Rawlins,J., Blanton,M.D.; Wild,J.R.; Gonzalez,C. Enhancing Biocides in Coatings: Antimicrobial Peptides. 2006. Paint Coat. Ind. 10:68-78.
6. Wales, M.E.; McDaniel, C.S.; Everett,A.L., Rawlins,J., Blanton,M.D., Busquets,A., Wild,J.R.; Gonzalez,C. Next Generation Antimicrobial Additives for Reactive Surface Coatings. 2006. Paint Coat. Ind. 7:62-70.

Select and Recent Presentations (Invited only)

1. "Biocide Basics" European Coatings Congress: Novel Biocides Pre-conference Workshop. Berlin, Germany, Sept, 2009.
2. "Antimicrobial Surfaces" American Coatings Congress. Pre-conference Workshop. Charlotte, NC, June, 2008 and 2010.
3. "Agents of Bioterror", Texas Training Initiative for Emergency Response (T-TIER), Sponsors: Center for Disease Control and Texas A&M University School of Rural and Public Health, College Station, TX, May, 2007
4. "Enzyme Technology: Applications for the Decontamination of Organophosphorus Agents." NATO Organisation for the Prohibition of Chemical Weapons (OPCW), The Hague, The Netherlands, Sept 2007.
5. "Design of a Multi-Talented Enzyme-Based Consortium for the Destruction of Neurotoxic CW

Agents", 1st Annual CounterACT Network Research Symposium. Sponsor: NIH, Washington, D.C. April, 2007

6. "Antimicrobial Peptides in the Development of Reactive Coatings", European Coatings Conference: Novel Biocides, Berlin, Germany, Feb, 2007.
7. "Pyrimidine Nucleotide De Novo Biosynthesis as a Model of Metabolic Control" International Conference on Arginine and Pyrimidines" Sponsor: University of Lund, Lund, Sweden, August, 2006.
8. "From Traditional Biology to Synthetic Biology and Cell Like Entities" Cell-Like Entity (CLE) Workshop, Sponsor: Air Force Research Laboratory, Fairfield, OH. Sept, 2005.
9. "Application of Enzymes in Bioactive Paints and Coatings" Sponsor: Coatings Science International, Noordwijk, The Netherlands. June, 2005.